The following listing of claims replaces and supercedes any prior listing of claims:

Listing of Claims:

1. (withdrawn)A method of producing neutrons in a chamber containing an ion source region, an accelerator region and a gas target region, comprising the steps of;

   a. generating deuterium ions in the ion source region,
   b. accelerating deuterium ions to high-energy by the application of an electric field in the accelerator region,
   c. allowing deuterium ions to collide with deuterium gas targets in the gas target region, producing neutron-generating fusion reactions.

2. (withdrawn)The method according to claim 1 wherein the gas targets are replenishable.

3. (withdrawn)The method according to claim 1 further comprising the step of placing the chamber in an inactive state in which state neutron-generating fusion reactions do not occur.

4. (withdrawn)The method according to claim 1 wherein the deuterium gas targets comprise a mixture of deuterium and tritium gas for high-energy neutron generation.

5. (withdrawn)The method according to claim 1 wherein the ion source comprises an ion source selected from the group consisting of a Penning ion source, a plasmatron, a duoplasmatron, a radio frequency ion source, a quadrapole ion source, and a discharge ion source.

6. (withdrawn)The method according to claim 1 further comprising the step of minimizing the production and transmission of electrons through the accelerator region.

7. (withdrawn)The method according to claim 6 wherein the step of minimizing the production and transmission of electrons through the accelerator region provides greater neutron generation per unit ion current than that prior to the step of minimizing.

Claims 8-27 (Cancelled).

28. (withdrawn)A method of producing neutrons in a chamber containing an anode electrode and a semi-transparent cathode electrode comprising the steps of;

introducing a fusible gas into the vacuum chamber;

creating a voltage differential between the cathode electrode and the anode electrode whereby a high-pressure high-resistance gaseous discharge forms primarily between the anode electrode and at least one semi-transparent surface of the cathode electrode and extends through openings of the semi-transparent cathode into an intra-cathode region defined by at least one surface of the cathode electrode, and whereby ions selected from the group consisting of deuterium ions and tritium ions of said discharge are accelerated by said voltage differential, with a substantial portion of said ions passing through the openings of the semi-transparent cathode surfaces;

allowing a portion of said ions to undergo charge-exchange collisions with background gas particles to produce fast-neutral particles selected from the group consisting of deuterium particles and tritium particles, whereby a portion of said fast neutral particles pass through the openings of the semi-transparent cathode surfaces, and whereby said high-resistance gaseous discharge is sustained primarily through charged particle generation initiated by the ions and fast neutral particles; and

generating neutrons from said high-pressure high-resistance gaseous discharge predominantly as a product of fusion collisions occurring between said ions and background gas particles and between said fast-neutral particles and background gas particles.

29. (withdrawn)The method according to claim 28 wherein at least a portion of background gas particles that experience collisions with ions or fast-neutral particles

are situated on a surface of a material within the vacuum chamber at the time that they experience the collisions.

30. (withdrawn)The method according to claim 29, wherein the portion of background gas particles that are situated on a surface of a material within the vacuum chamber are attached to the surface by chemical adsorption.

31. (withdrawn)The method according to claim 29, wherein the portion of background gas particles that are situated on a surface of a material within the vacuum chamber are attached to the surface by physical adsorption.

32. (withdrawn)The method according to claim 28, wherein the chamber and electrodes have a shape selected to produce neutrons with a spatial distribution dependent on the high-pressure high-resistance discharge volume within the shape.

33. (withdrawn)The method according to claim 28 wherein the chamber further comprises an electron management system to augment neutron production power efficiency of the method by reducing power consumption attributable to electrons generated in the vacuum chamber and conducted through the gaseous discharge.

34. (withdrawn)The method according to claim 33 wherein the electron management system comprises a feature selected from the group consisting of electrode surface treatments and low-secondary electron emission materials to reduce secondary electron formation.

35. (withdrawn)The method according to claim 33 wherein the electron management system provides electric potential repression of the intra-cathode region to reduce secondary electron formation.

36. (withdrawn)The method according to claim 33 wherein the electron management system comprises baffle electrodes to minimize intra-cathode region errant particle and electron paths for minimization of electron generation.

37. (withdrawn)The method according to claim 33 wherein the electron management system comprises the placement of surfaces to promote electron-ion recombination within the intra-cathode region to minimize power losses.

38. (withdrawn)The method according to claim 28 wherein the cathode further comprises at least one non-transparent surface for impeding the movement of gaseous discharge particles.

39. (withdrawn)The method according to claim 28 wherein the at least one semi-transparent surface of the cathode comprises a plurality of openings that are sufficiently large so as to allow passage of ions and fast neutral particles.

40. (withdrawn)The method according to claim 28 wherein the anode electrode is comprised of an inner surface of the vacuum chamber.

41. (withdrawn)The method according to claim 28 wherein the anode electrode comprises openings and is semi-transparent to nuclear and atomic particles.

42. (withdrawn)The method according to claim 28 wherein the chamber further comprises a gas pressure storage and regulation mechanism for storing at least a portion of the deuterium gas and for regulating a pressure of the deuterium gas in the vacuum chamber.

43. (withdrawn)The method according to claim 28 further comprising the step of storing at least a portion of the deuterium gas and regulating a pressure of the deuterium gas using a getter material.

44. (withdrawn)The method according to claim 28 wherein the chamber further comprises a heat removal mechanism for preventing heat damage to the chamber.

Claims 45-67 (Cancelled).

68.(Currently Amended) A method of producing neutrons in a chamber containing an anode electrode, a ~~semi-transparent~~ suppressor cathode electrode, consisting of a semi-transparent electrically-conducting material that limits electron flow to said anode, and a ~~semi-transparent~~ leeching cathode electrode, consisting of a semi-transparent electrically-conducting material that removes electrons, comprising the steps of; introducing a fusible gas, comprising either deuterium gas or a mixture of deuterium and tritium gas, into the vacuum chamber; creating ~~a voltage differential~~ high voltage differentials between the cathode electrodes, comprised of said suppressor electrode and said leeching electrode, and ~~the~~ said anode electrode, ~~and applying a high voltage to the leeching cathode, and a bias voltage to the suppressor electrode relative to the leeching cathode, whereby~~ and a bias voltage to said suppressor electrode relative to said leeching cathode, such that a high-pressure high-resistance gaseous discharge forms primarily between ~~the~~ said anode and ~~semi-transparent suppressor surfaces~~ said cathode electrodes and extends through the openings of ~~the~~ said semi-transparent ~~suppressor electrode surfaces~~ cathode electrodes, passing through ~~the~~ said suppressor electrode and said leeching ~~electrodes~~ electrode and an intra-cathode region defined by ~~at least one surface of the cathode electrode~~ the volume enclosed by said suppressor electrode, and ~~whereby~~ such that ions ~~selected~~ resulting from said gaseous discharge and constituted from the group consisting of ~~deuterium ions and tritium ions of said gaseous discharge~~ said fusible gas are accelerated by ~~the~~ said voltage differential, with a substantial portion of said ions passing through the openings of ~~the~~ said semi-transparent cathode ~~surfaces~~ electrodes; allowing a portion of said ions to undergo charge-exchange collisions with background gas particles, comprised of said fusible gas, to ~~produce~~ become fast-neutral particles selected from the group consisting of deuterium particles and tritium particles, ~~whereby~~ such that a portion

of said fast-neutral particles pass through ~~the~~ said openings of ~~the~~ said semi-transparent cathode ~~surfaces~~ electrodes, and ~~whereby said~~ such that a high-pressure high-resistance gaseous discharge is sustained primarily through charged particle generation initiated by ~~the~~ said ions and said fast neutral particles; and generating neutrons from said high-pressure high-resistance gaseous discharge as a product of fusion collisions occurring

between said ions and said background gas particles and between said fast-neutral particles and said background gas particles.

69.(Currently Amended) The method according to claim 68 wherein at least a portion of said background gas particles that experience collisions with said ions ~~or~~ and said fast-neutral particles are situated on a surface of a material within the vacuum chamber ~~at the time that they experience the collisions~~.

70. (withdrawn)The method according to claim 69, wherein the portion of background gas particles that are situated on a surface of a material within the vacuum chamber are attached to the surface by chemical adsorption.

71.(Currently Amended) The method according to claim 69, wherein ~~the~~ said portion of said background gas particles that are situated on a said surface ~~of a material~~ within ~~the~~ said vacuum chamber are attached to ~~the~~ said surface by physical adsorption.

72. (Currently Amended) The method according to claim 68, wherein ~~the~~ said chamber and said electrodes have a shape selected to produce said neutrons with a spatial distribution dependent on the volume occupied by said high-pressure high-resistance discharge ~~volume~~ within ~~the~~ said shape.

73. (Currently Amended) The method according to claim 68, further comprising the step of employing an electron management system to augment the neutron production power

efficiency of ~~the~~ said ~~method through~~ high-pressure high-resistance gaseous discharge by adjustment of said bias voltage resulting in the reduction of space-charge buildup and power consumed by the production or conduction of electrons ~~through the gaseous discharge~~ in said high-pressure high-resistance gaseous discharge.

74. (withdrawn)The method according to claim 73 wherein the electron management system comprises a feature selected from the set consisting of electrode surface treatments and the use of low secondary electron emission materials to reduce secondary electron formation.

75. (withdrawn)The method according to claim 73 wherein the electron management system provides electric potential repression of the intra-cathode region to reduce secondary electron formation.

76. (Currently Amended) The method according to claim 73 wherein ~~the~~ said electron management system further comprises baffle electrodes, comprising electrically-conductive material with an electrical connection selected from the group of electrically floating or electrically connected to said leeching electrode, situated within said intra-cathode region to ~~minimize intra-cathode region~~ further inhibit space charge build up and to intercept errant particle and electron paths for minimization of electron generation.

77. (withdrawn)The method according to claim 73 wherein the electron management system comprises the placement of surfaces to promote electron-ion recombination within the intra-cathode region to minimize power losses.

Claims 78-161 (Cancelled).

In re Application of : Jurczyk et al.
Application No. 10/058,561

Respectfully submitted,

Phillip M. Pippenger, Reg. No. 46,055
LEYDIG, VOIT & MAYER, LTD.
Two Prudential Plaza, Suite 4900
180 N. Stetson Ave.
Chicago, Illinois 60601
(312) 616-5600 (telephone)
(312) 616-5700 (facsimile)